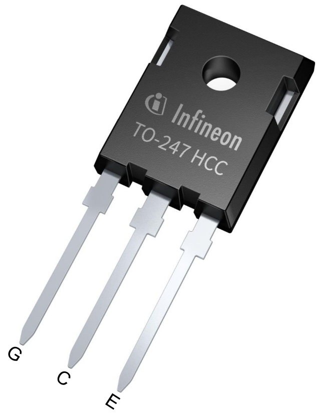
TRENCHSTOP™ 5 WR5 technology in enhanced creepage and clearance package offers improved reliability against package contamination



Features

- V_{CE} = 650 V
- I_C = 30 A
- Pin-to-pin creepage distance > 4.8 mm
- Pin-to-pin clearance distance > 3.4 mm
- Monolithic diode optimized for PFC and welding applications
- Stable temperature behavior
- Very low V_{CEsat} and low E_{off}
- Easy parallel switching capability based on positive temperature coefficient of V_{CEsat}
- Low temperature dependence of V_{CEsat} and E_{sw}
- Product spectrum and PSpice Models: http://www.infineon.com/igbt/

Potential applications

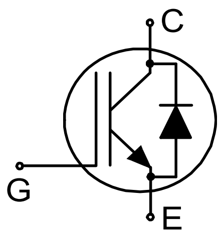
- PFC
- Welding
- ZCS applications

Product validation

- Qualified for industrial applications according to the relevant tests of JEDEC47/20/22

Lead-Free
Green
Halogen-Free
RoHS

Description



Type	Package	Marking
IKWH30N65WR5	PG-TO247-3-STD-N4.8	H30EWR5

Table of contents

1 Package

Table 1 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Internal emitter inductance measured 5 mm (0.197 in) from case	L_E			13.0		nH
Storage temperature	T_{stg}		-55		150	°C
Soldering temperature		wave soldering 1.6 mm (0.063 in.) from case for 10 s			260	°C
Mounting torque	M	M3 screw Maximum of mounting process: 3			0.6	Nm
Thermal resistance, junction-ambient	$R_{th(j-a)}$				40	K/W

2 IGBT

Table 2 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CE}	$T_{vj} \geq 25$ °C		650	V
DC collector current, limited by T_{vjmax}	I_C		$T_c = 25$ °C	75	A
			$T_c = 100$ °C	49	
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpulse}			90	A
Turn-off safe operating area		$V_{CE} \leq 650$ V, $t_p \leq 1$ µs, $T_{vj} \leq 175$ °C		90	A
Gate-emitter voltage	V_{GE}			±20	V
Transient gate-emitter voltage	V_{GE}	$t_p \leq 10$ µs, $D < 0.01$		±30	V
Power dissipation	P_{tot}		$T_c = 25$ °C	190	W
			$T_c = 100$ °C	95	

Table 3 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter breakdown voltage	V_{BRCES}	$I_C = 0.2$ mA, V_{GE}=0 V		650			V
Collector-emitter saturation voltage	V_{CEsat}	$I_C = 30$ A, $V_{GE} = 15$ V	$T_{vj} = 25$ °C		1.4	1.7	V
			$T_{vj} = 175$ °C		1.65		
Gate-emitter threshold voltage	V_{GEth}	$I_C = 0.3$ mA, $V_{CE} = V_{GE}$		3.2	4	4.8	V

(table continues...)

Table 3 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Zero gate-voltage collector current	I_{CES}	V_{CE} = 650 V, V_{GE}=0 V	T_{vj} = 25 °C			40	µA
			T_{vj} = 175 °C		0.5		mA
Gate-emitter leakage current	I_{GES}	V_{CE}=0 V, V_{GE} = 20 V				100	nA
Transconductance	g_{fs}	I_C = 30 A, V_{CE} = 20 V			67		S
Input capacitance	C_{ies}	V_{CE} = 25 V, V_{GE}=0 V, f = 100 kHz			3230		pF
Output capacitance	C_{oes}	V_{CE} = 25 V, V_{GE}=0 V, f = 100 kHz			32		pF
Reverse transfer capacitance	C_{res}	V_{CE} = 25 V, V_{GE}=0 V, f = 100 kHz			13		pF
Gate charge	Q_G	I_C = 30 A, V_{GE} = 15 V, V_{CC} = 520 V			133		nC
Turn-on delay time	t_{don}	V_{CC} = 400 V, V_{GE} = 0/15 V, R_{Gon} = 27 Ω, R_{Goff} = 27 Ω, $L_σ$ = 30 nH, $C_σ$ = 28 pF	T_{vj} = 25 °C, I_C = 30 A		41		ns
			T_{vj} = 175 °C, I_C = 30 A		33		
Rise time (inductive load)	t_r	V_{CC} = 400 V, V_{GE} = 0/15 V, R_{Gon} = 27 Ω, R_{Goff} = 27 Ω, $L_σ$ = 30 nH, $C_σ$ = 28 pF	T_{vj} = 25 °C, I_C = 30 A		20		ns
			T_{vj} = 175 °C, I_C = 30 A		21		
Turn-off delay time	t_{doff}	V_{CC} = 400 V, V_{GE} = 0/15 V, R_{Gon} = 27 Ω, R_{Goff} = 27 Ω, $L_σ$ = 30 nH, $C_σ$ = 28 pF	T_{vj} = 25 °C, I_C = 30 A		398		ns
			T_{vj} = 175 °C, I_C = 30 A		458		
Fall time (inductive load)	t_f	V_{CC} = 400 V, V_{GE} = 0/15 V, R_{Gon} = 27 Ω, R_{Goff} = 27 Ω, $L_σ$ = 30 nH, $C_σ$ = 28 pF	T_{vj} = 25 °C, I_C = 30 A		18		ns
			T_{vj} = 175 °C, I_C = 30 A		18		
Turn-on energy	E_{on}	V_{CC} = 400 V, V_{GE} = 0/15 V, R_{Gon} = 27 Ω, R_{Goff} = 27 Ω, $L_σ$ = 30 nH, $C_σ$ = 28 pF	T_{vj} = 25 °C, I_C = 30 A		0.87		mJ
			T_{vj} = 175 °C, I_C = 30 A		1.04		
Turn-off energy	E_{off}	V_{CC} = 400 V, V_{GE} = 0/15 V, R_{Gon} = 27 Ω, R_{Goff} = 27 Ω, $L_σ$ = 30 nH, $C_σ$ = 28 pF	T_{vj} = 25 °C, I_C = 30 A		0.4		mJ
			T_{vj} = 175 °C, I_C = 30 A		0.7		
Total switching energy	E_{ts}	V_{CC} = 400 V, V_{GE} = 0/15 V, R_{Gon} = 27 Ω, R_{Goff} = 27 Ω, $L_σ$ = 30 nH, $C_σ$ = 28 pF	T_{vj} = 25 °C, I_C = 30 A		1.27		mJ
			T_{vj} = 175 °C, I_C = 30 A		1.74		

(table continues...)

Table 3 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
IGBT thermal resistance, junction to case	R_{thjc}				0.8	K/W
Operating junction temperature	T_{vj}		-40		175	°C

Note: *Electrical Characteristic, at T_{vj} = 25°C, unless otherwise specified.*

3 Diode

Table 4 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}	$T_{vj} \geq 25$ °C		650	V
Diode forward current, limited by T_{vjmax}	I_F		$T_c = 25$ °C	23	A
			$T_c = 100$ °C	13	
Diode pulsed current, limited by T_{vjmax}	I_{Fpulse}			45	A

Table 5 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Diode forward voltage	V_F	$I_F = 12$ A	$T_{vj} = 25$ °C		1.3	1.6	V
			$T_{vj} = 175$ °C		1.35		
Diode reverse recovery charge	Q_{rr}	$V_R = 400$ V	$T_{vj} = 25$ °C, $I_F = 15$ A, $-di_F/dt = 1400$ A/µs		1.9		µC
			$T_{vj} = 175$ °C, $I_F = 15$ A, $-di_F/dt = 1300$ A/µs		2.6		
Diode peak reverse recovery current	I_{rrm}	$V_R = 400$ V	$T_{vj} = 25$ °C, $I_F = 15$ A, $-di_F/dt = 1400$ A/µs		28.6		A
			$T_{vj} = 175$ °C, $I_F = 15$ A, $-di_F/dt = 1300$ A/µs		39		
Diode thermal resistance, junction to case	R_{thjc}					3.3	K/W

(table continues...)

Table 5 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Operating junction temperature	T_{vj}		-40		175	°C

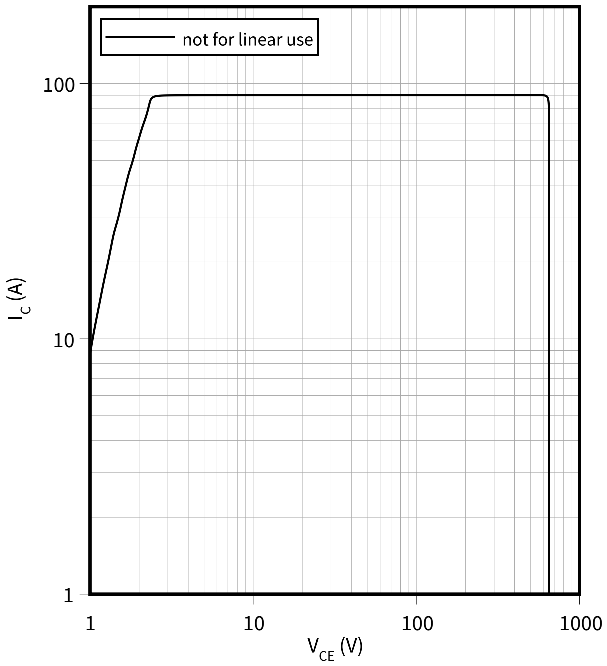
Note: For optimum lifetime and reliability, Infineon recommends operating conditions that do not exceed 80% of the maximum ratings stated in this datasheet.

4 Characteristics diagrams

Reverse bias safe operating area

$I_C = f(V_{CE})$

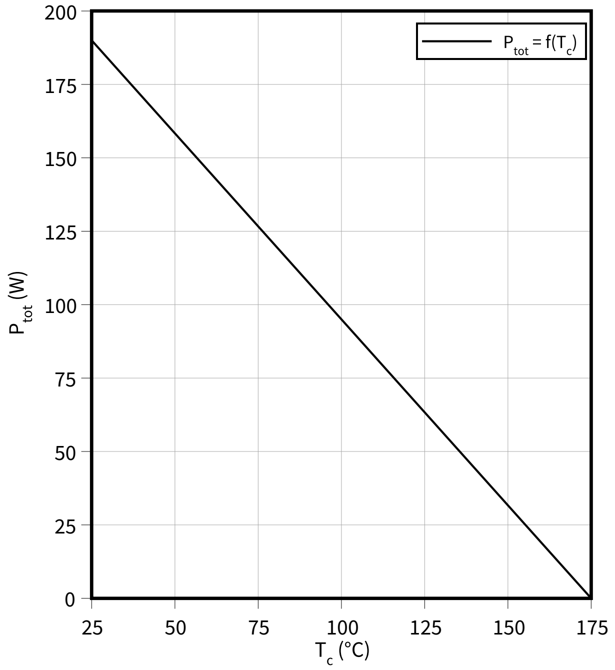
$t_p = 1\ \mu s$, $D = 0$, $T_{vj} \leq 175\ °C$, $T_c = 25\ °C$, $V_{GE} = 15\ V$



Power dissipation as a function of case temperature

$P_{tot} = f(T_c)$

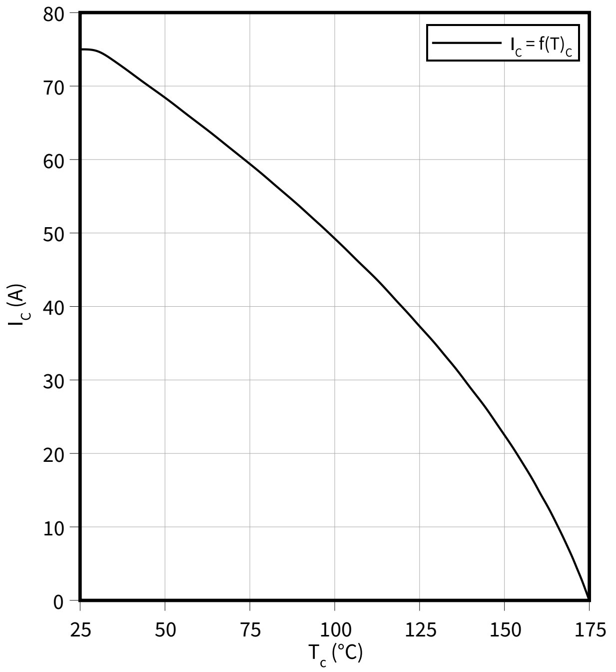
$T_{vj} \leq 175\ °C$



Collector current as a function of case temperature

$I_C = f(T_c)$

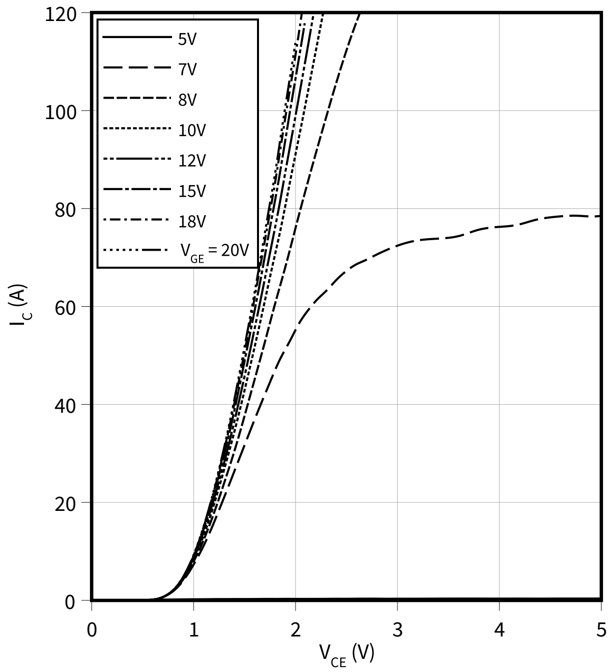
$T_{vj} \leq 175\ °C$, $V_{GE} \geq 15\ V$



Typical output characteristic

$I_C = f(V_{CE})$

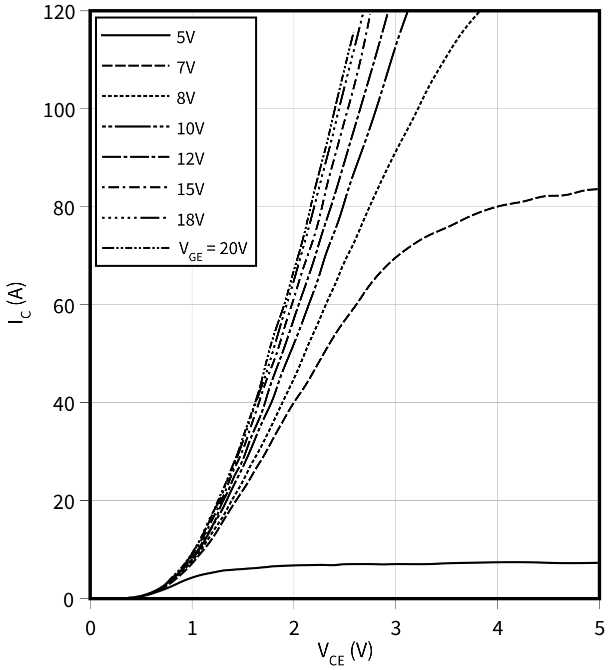
$T_{vj} = 25\ °C$



Typical output characteristic

$I_C = f(V_{CE})$

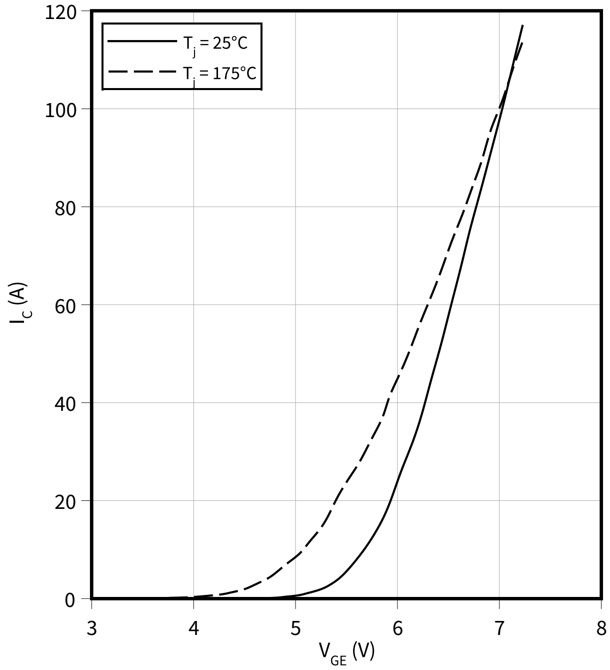
$T_{vj} = 175\ °C$



Typical transfer characteristic

$I_C = f(V_{GE})$

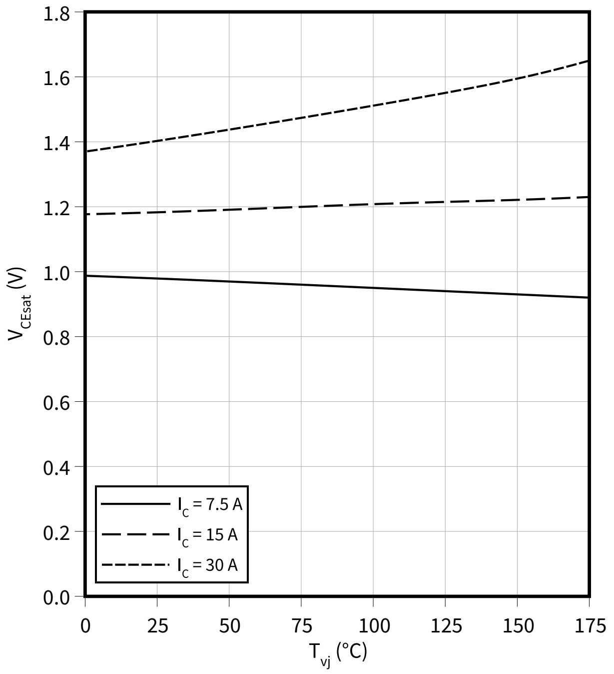
$V_{CE} = 20\ V$



Typical collector-emitter saturation voltage as a function of junction temperature

$V_{CEsat} = f(T_{vj})$

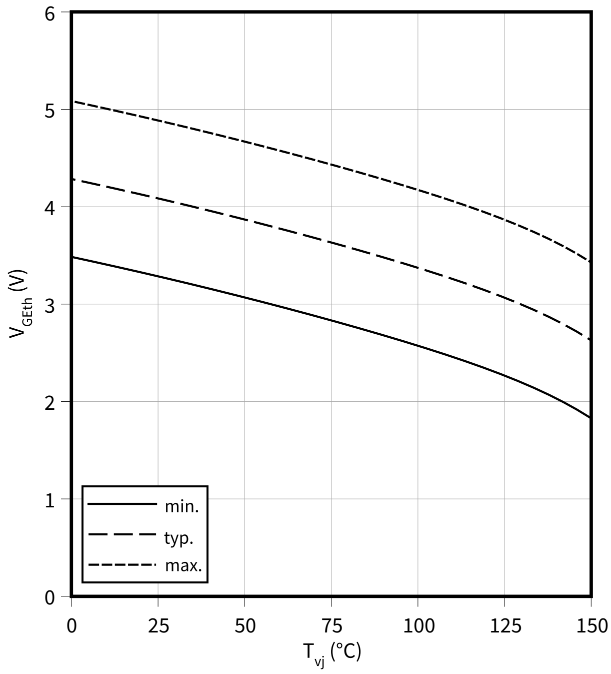
$V_{GE} = 15\ V$



Gate-emitter threshold voltage as a function of junction temperature

$V_{GEth} = f(T_{vj})$

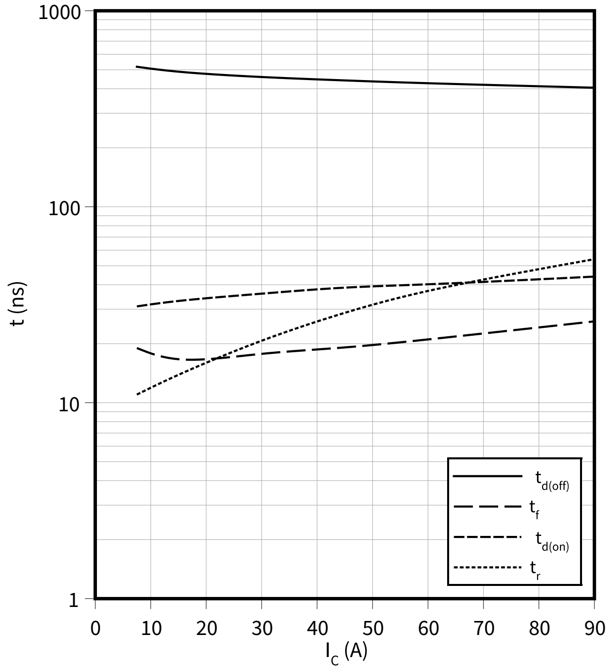
$I_C = 0.2\ mA$



Typical switching times as a function of collector current

$t = f(I_C)$

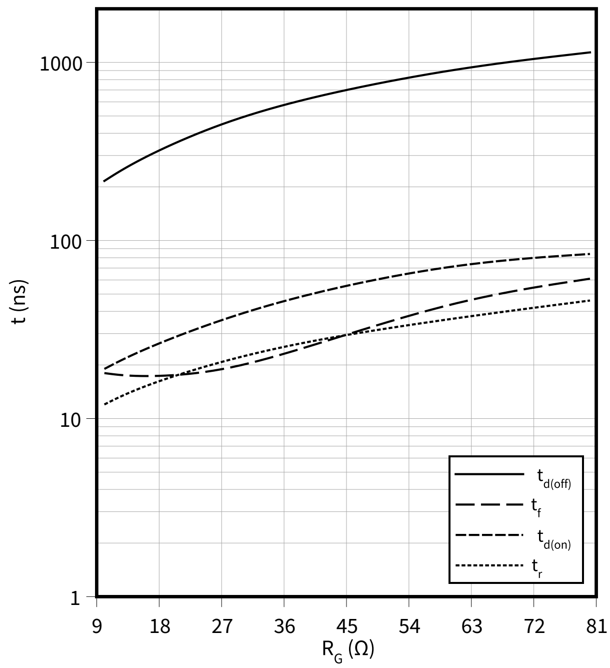
$V_{CC} = 400$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V, $R_G = 27\ \Omega$



Typical switching times as a function of gate resistor

$t = f(R_G)$

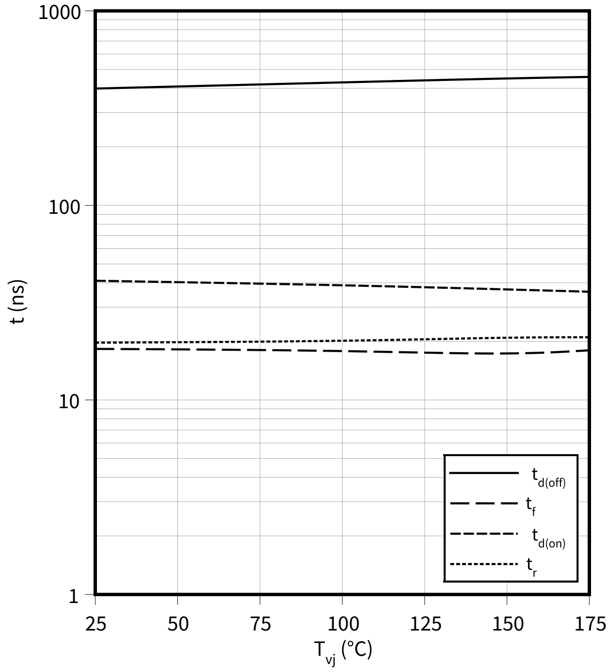
$I_C = 30$ A, $V_{CC} = 400$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V



Typical switching times as a function of junction temperature

$t = f(T_{vj})$

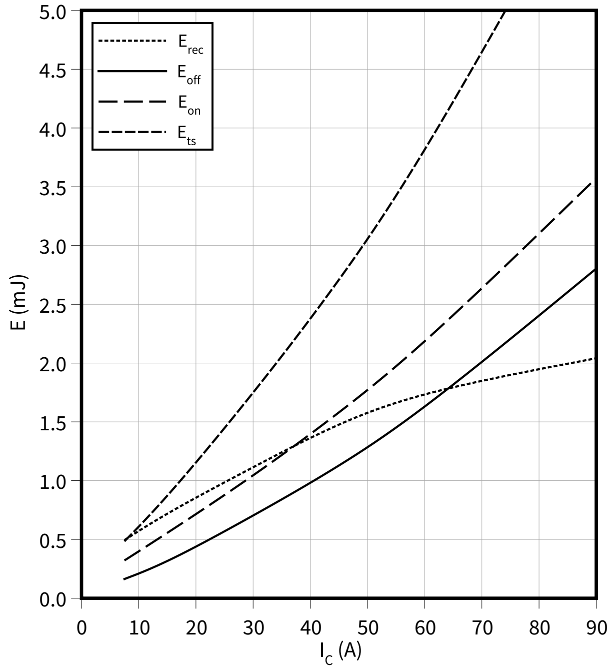
$I_C = 30$ A, $V_{CC} = 400$ V, $V_{GE} = 0/15$ V, $R_G = 27\ \Omega$



Typical switching energy losses as a function of collector current

$E = f(I_C)$

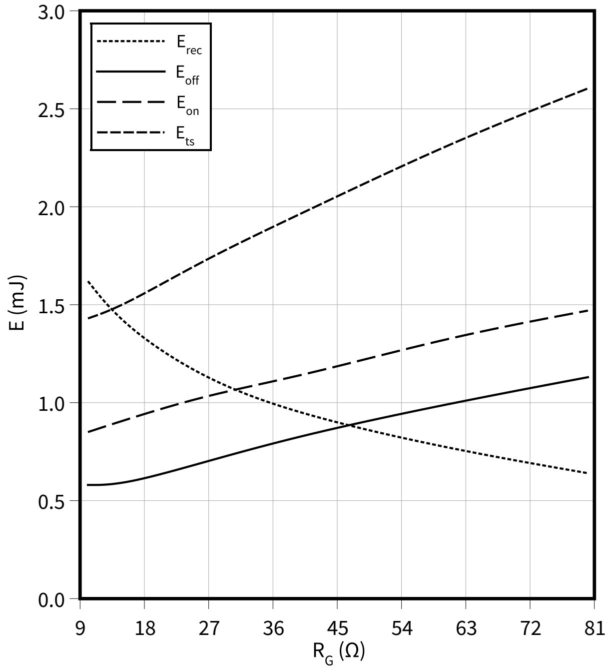
$V_{CC} = 400$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V, $R_G = 27\ \Omega$



Typical switching energy losses as a function of gate resistor

$E = f(R_G)$

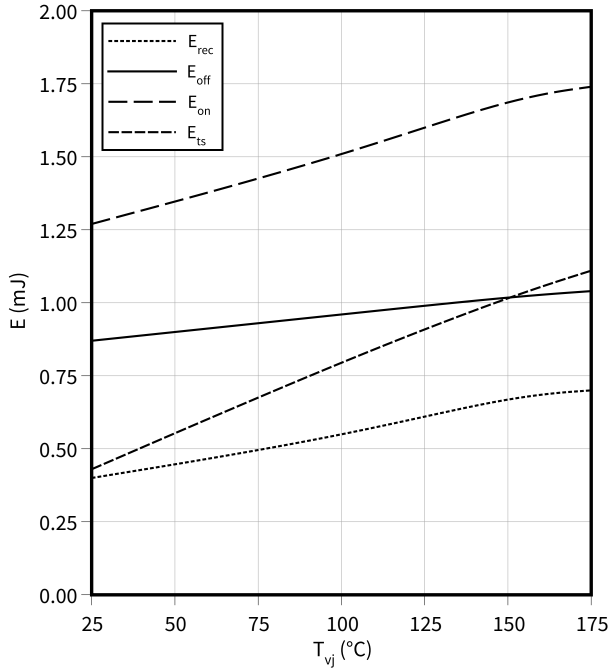
I_C = 30 A, V_{CC} = 400 V, T_{vj} = 175 °C, V_{GE} = 0/15 V



Typical switching energy losses as a function of junction temperature

$E = f(T_{vj})$

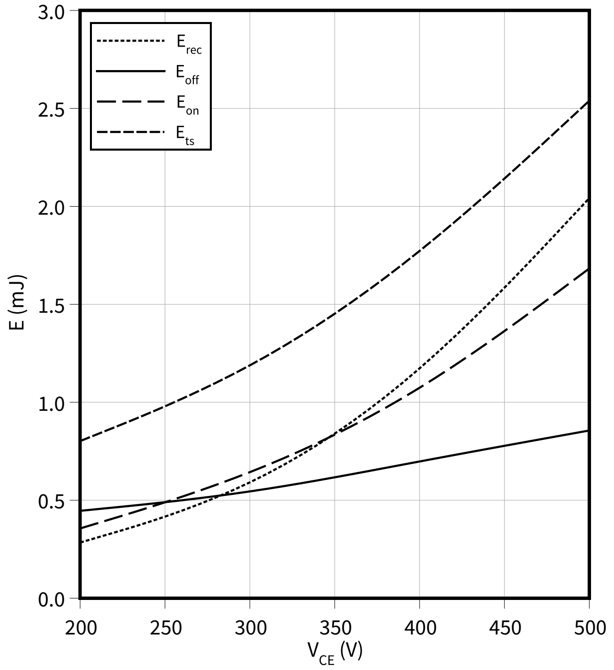
I_C = 30 A, V_{CC} = 400 V, V_{GE} = 0/15 V, R_G = 27 Ω



Typical switching energy losses as a function of collector emitter voltage

$E = f(V_{CE})$

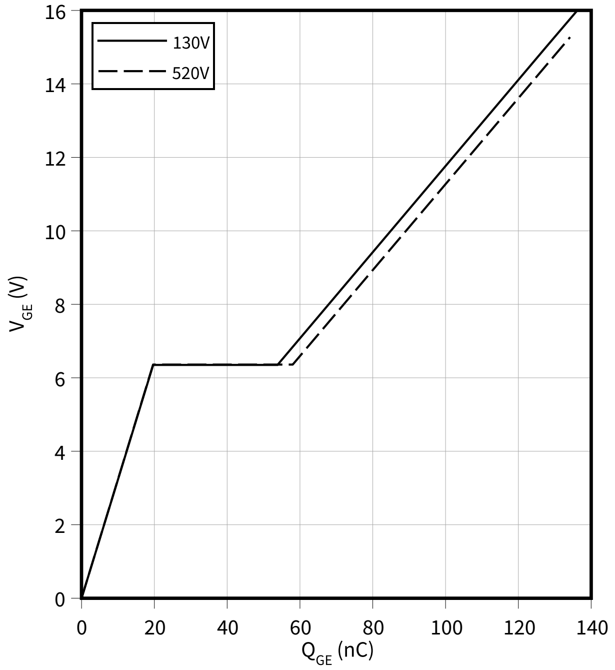
I_C = 30 A, T_{vj} = 175 °C, V_{GE} = 0/15 V, R_G = 27 Ω



Typical gate charge

$V_{GE} = f(Q_{GE})$

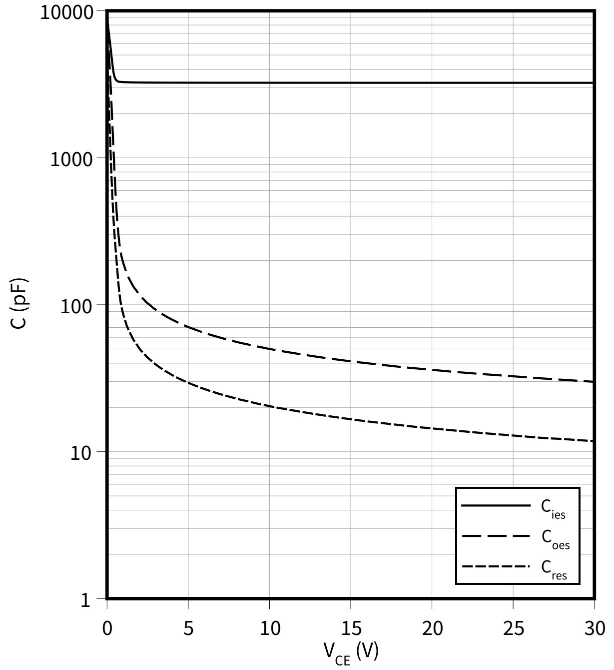
I_C = 30 A



Typical capacitance as a function of collector-emitter voltage

$C = f(V_{CE})$

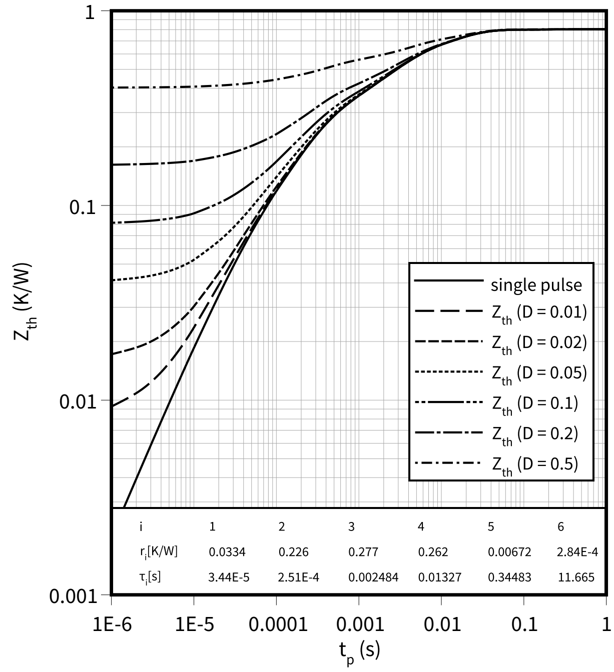
$V_{GE} = 0$ V, f = 100 kHz



IGBT transient thermal impedance as a function of pulse width

$Z_{th} = f(t_p)$

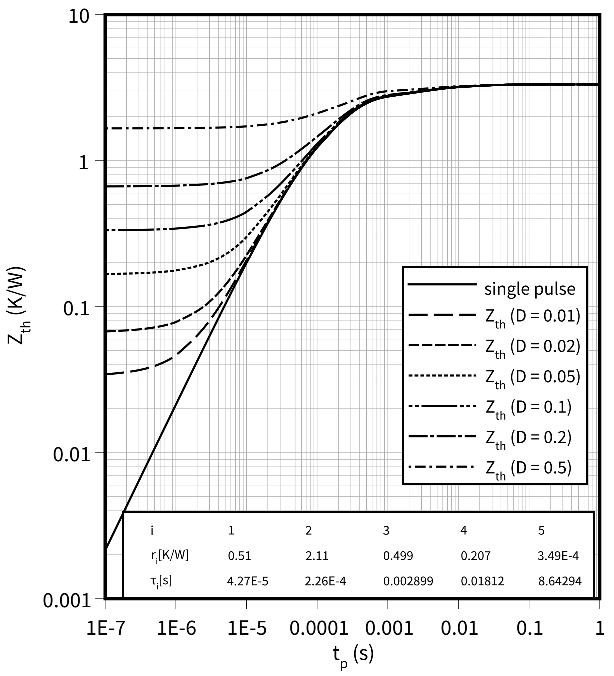
$D = t_p/T$



Diode transient thermal impedance as a function of pulse width

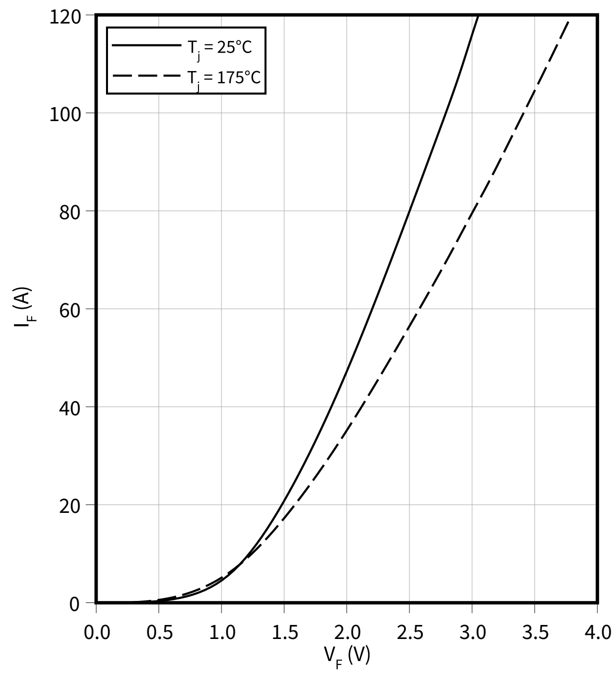
$Z_{th} = f(t_p)$

$D = t_p/T$



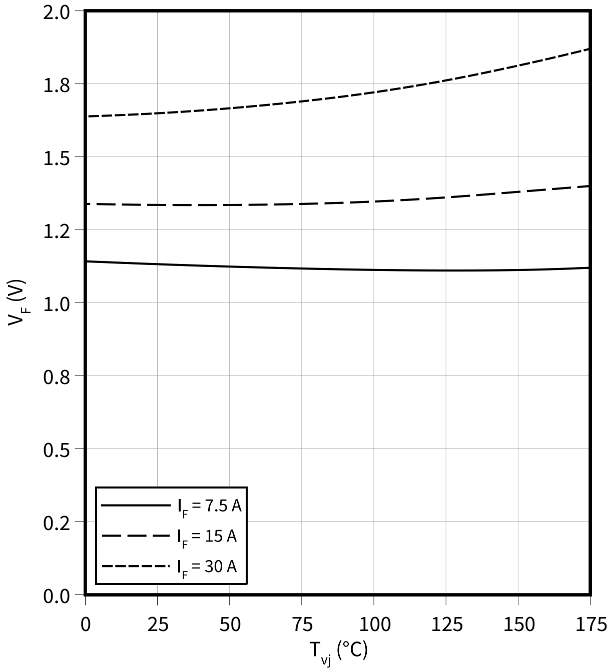
Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



Typical diode forward voltage as a function of junction temperature

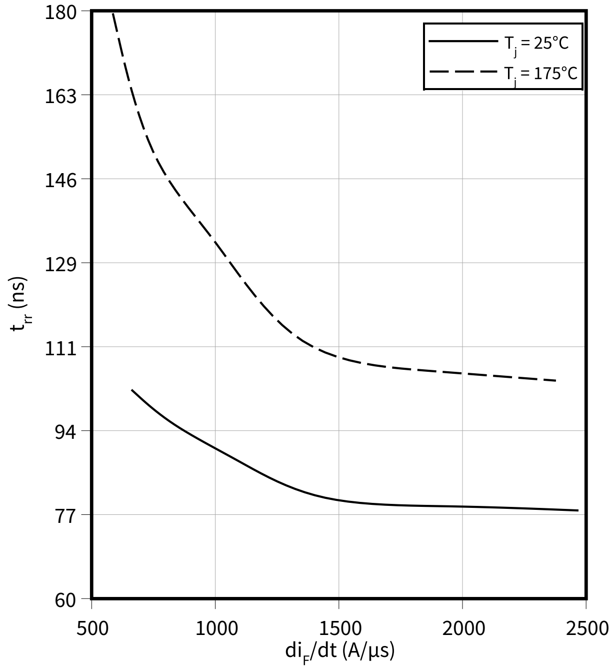
$V_F = f(T_{vj})$



Typical reverse recovery time as a function of diode current slope

$t_{rr} = f(di_F/dt)$

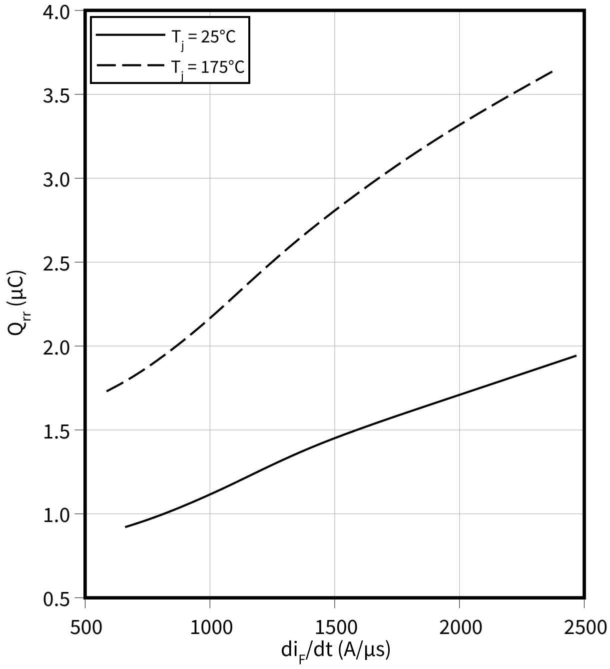
$V_R = 400$ V, $I_F = 15$ A



Typical reverse recovery charge as a function of diode current slope

$Q_{rr} = f(di_F/dt)$

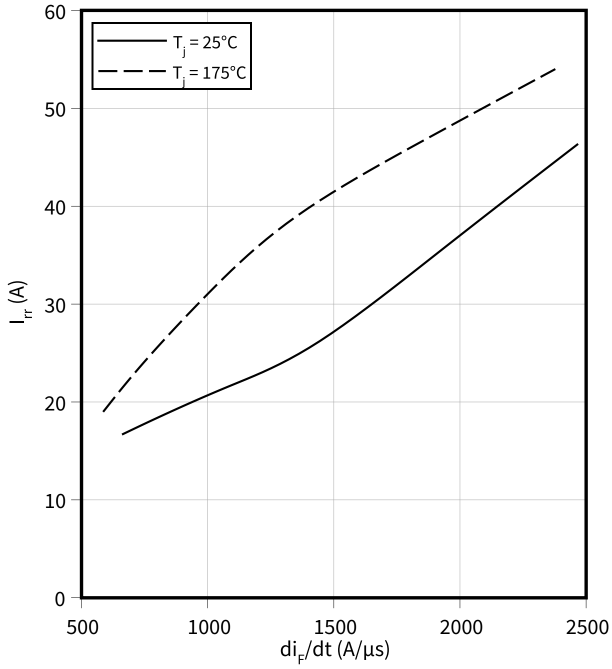
$V_R = 400$ V, $I_F = 15$ A



Typical reverse recovery current as a function of diode current slope

$I_{rr} = f(di_F/dt)$

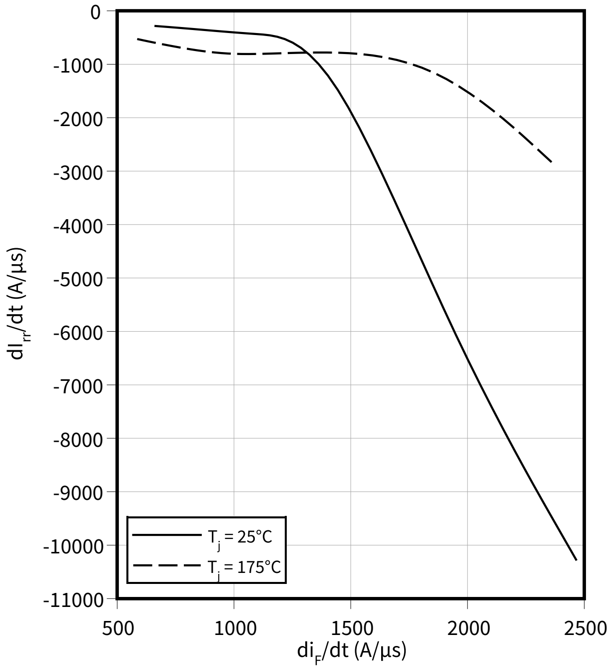
$V_R = 400$ V, $I_F = 15$ A



Typical diode peak rate of fall of reverse recovery current as a function of diode current slope

$dI_{rr}/dt = f(di_F/dt)$

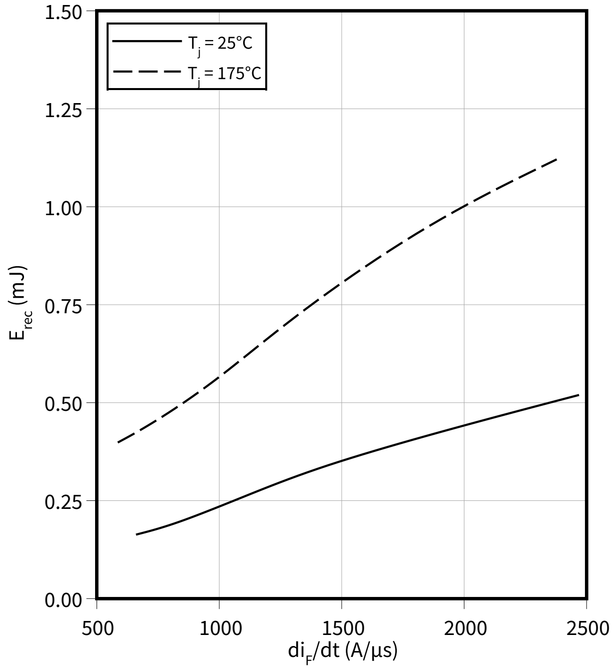
$V_R = 400$ V, $I_F = 15$ A



Typical reverse energy losses as a function of diode current slope

$E_{rec} = f(di_F/dt)$

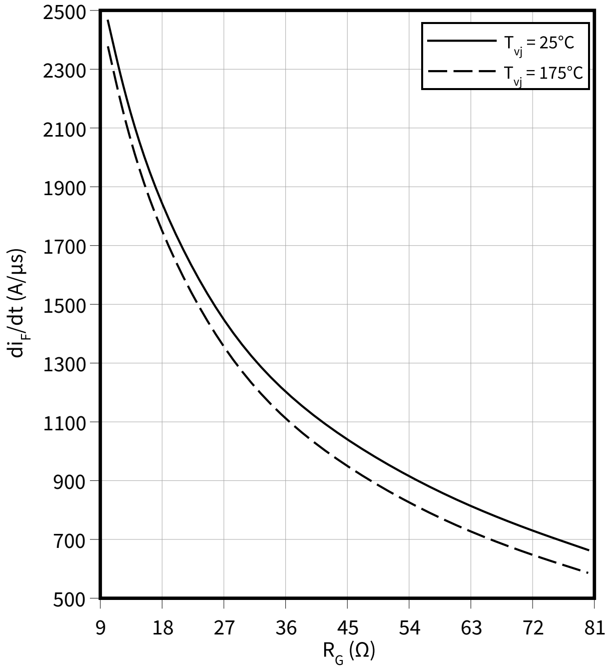
$V_R = 400$ V, $I_F = 15$ A



Typical diode current slope as a function of gate resistor

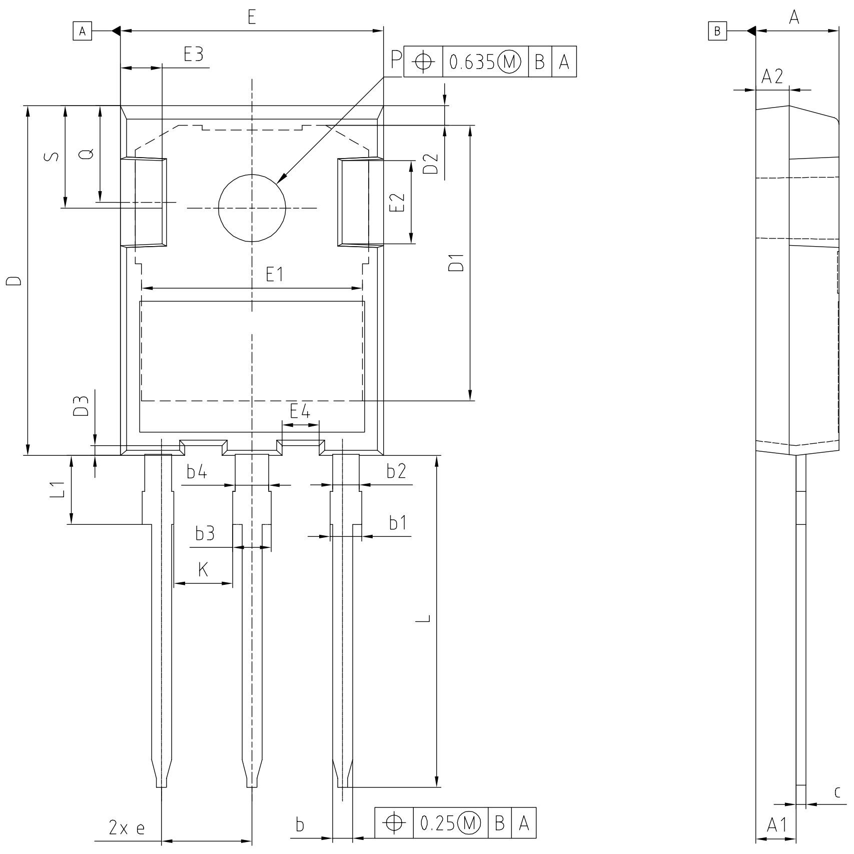
$di_F/dt = f(R_G)$

$V_R = 400$ V, $I_F = 15$ A



5 Package outlines

PG-TO247-3-STD-N4.8



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.83	5.21	0.190	0.205
A1	2.27	2.54	0.089	0.100
A2	1.85	2.16	0.073	0.085
b	1.07	1.33	0.042	0.052
b1	1.48	2.02	0.058	0.080
b2	1.48	1.72	0.058	0.068
b3	1.84	2.42	0.072	0.095
b4	1.84	2.18	0.072	0.086
c	0.55	0.68	0.022	0.027
D	20.80	21.10	0.819	0.831
D1	16.25	16.85	0.640	0.663
D2	0.95	1.35	0.037	0.053
D3	0.55	0.65	0.022	0.026
E	15.70	15.90	0.618	0.626
E1	13.10	14.15	0.516	0.557
E2	4.90	5.10	0.193	0.201
E3	1.00	2.60	0.039	0.102
E4	3.44	3.76	0.135	0.148
e	5.44 (BSC)		0.214 (BSC)	
K	3.4	–	0.134	–
L	19.80	20.32	0.780	0.800
L1	3.95	4.30	0.156	0.169
øP	3.50	3.70	0.138	0.146
Q	5.6	6.00	0.220	0.236
S	5.95	6.35	0.234	0.250
N	3		3	

DOCUMENT NO.
Z8B00205969

SCALE 3:1
0 1 2 3mm

EUROPEAN PROJECTION

ISSUE DATE
31.03.2022

REVISION
1

Figure 1

6 Testing conditions

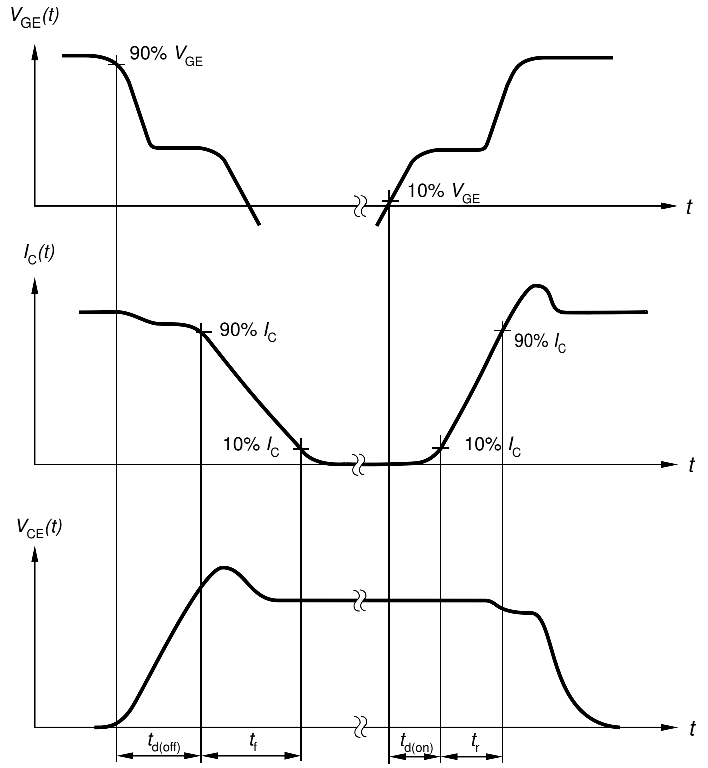


Figure A. **Definition of switching times**

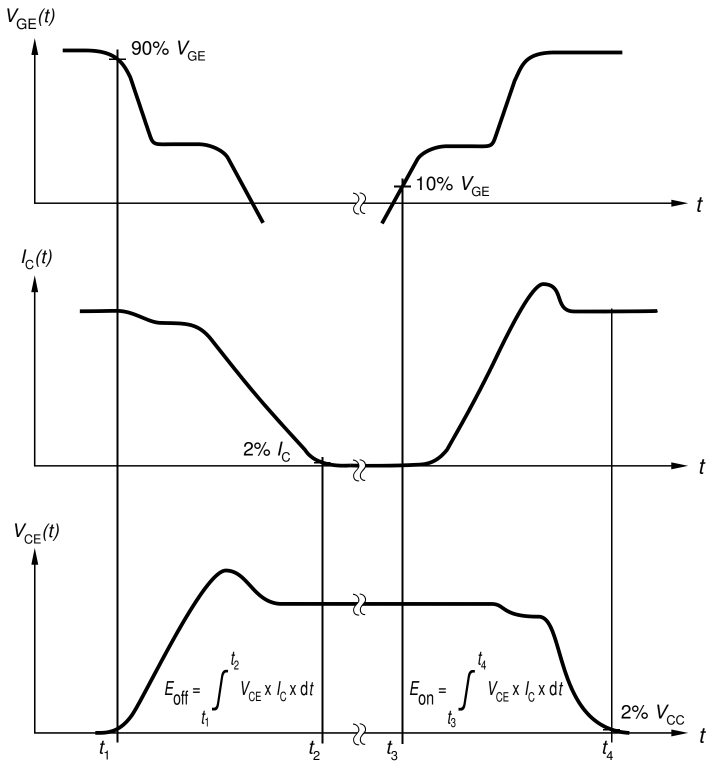


Figure B. **Definition of switching losses**

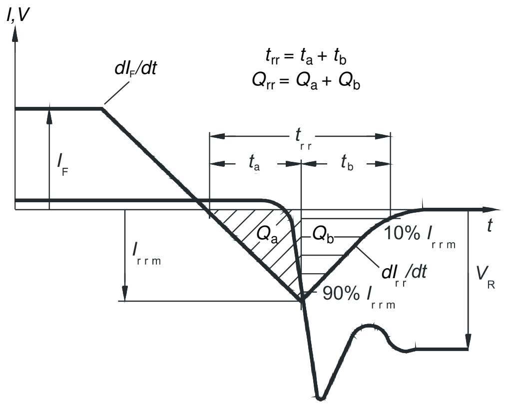


Figure C. **Definition of diode switching characteristics**

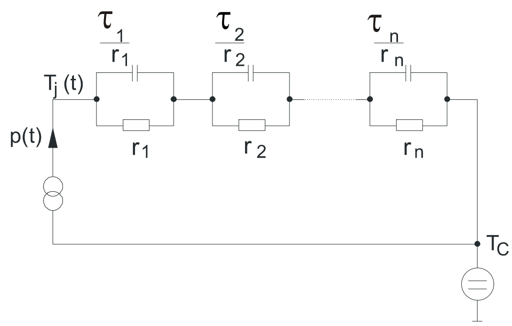


Figure D. **Thermal equivalent circuit**

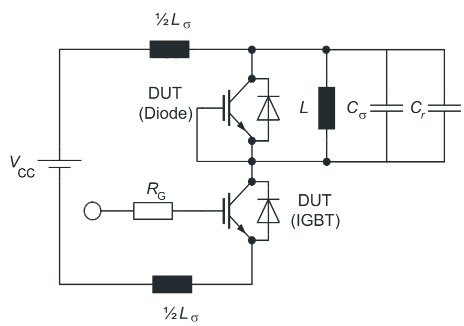


Figure E. **Dynamic test circuit**
Parasitic inductance L_{σ},
parasitic capacitor C_{σ},
relief capacitor C_r,
(only for ZVT switching)

Figure 2

Revision history

Document revision	Date of release	Description of changes
1.00	2021-05-17	Final datasheet
1.10	2021-05-18	Update of diagram E = f(Tvj)
1.20	2021-06-29	Update of diagram E = f(T_{vj})
1.30	2022-04-05	Update of “DC collector current, limited by T_{vjmax}” in table “Maximum rated values”, for 25°C and 100°C Transient gate-emitter voltage V_{GE} in table “Maximum rated values” of IGBT changed to ±30V Update of diagram “Collector current as a function of case temperature”, I_C = f(T_c) "Forward bias safe operating area” diagram renamed to “Reverse bias safe operating area” Correction of package outline dimensions Change package name to marketing name